Coding for Catapult Interview (Interview 1)

Sorting Order (Maximum points = 3)	4th	3rd	2nd	1st
0	C	B	A	D
	C	B	D	A
	B	C	A	D
	B	C	D	A
1	A	B	C	D
	A	B	D	C
	A	C	D	B
	A	C	B	D
	B	D	C	A
	B	D	A	C
	C	D	A	B
	C	D	B	A
2	A	D	C	B
	A	D	B	C
	D	C	B	A
	D	C	A	B
	D	B	A	C
	D	B	C	A
	B	A	C	D
	B	A	D	C
	C	A	B	D
	C	A	D	B
3	D	A	B	C
	D	A	C	B

Sorting Explanations

(*indicates an ambiguous response - probe more in order to code correctly)

Explaining throwing the rock

0 Can't tell, irrelevant, nonsense, etc.

	- I don't know
	- just because/ I think so
	- I collect rocks/I have a pet rock (irrelevant content)
	- other

1 Focus on Surface features or misconceptions

	-Can throw the rock to the cave
	-He could fall
	- other

2 Answer dependent on weight of rock/insufficient strength to throw rock

	-Rock too heavy to throw
	-No energy/strength or run out of energy strength, drop rock
	-need lot of strength to lift
	- other

Explaining jumping on the lever

0 Can't tell, nonsense, etc.

	I don't know
	just because/ I think so
	I can jump far/high (irrelevant content)
	other

1 Focus on Surface features or misconceptions

	fall down in hole
	Can't throw with hands
	*-Jump down on board --> throw further (without explicit mention of lever)
	people heavier than the rock
	other

2 Focus on Mechanism: reference to advantage <u>without</u> explanation

	-Jump down -->other side comes up and throw rock (explicit reference to lever action)
	-Board throws rock further than caveman
	*-don't have to pick up/carry rock
	*-easier to throw the rock
	-other

3 Focus on Mechanism: reference to advantage <u>with</u> explanation

	when rock is closer to the edge will go further
	More than one person can jump at same time (more force)
	other

Explaining the tree

0 Can't tell, irrelevant, nonsense, etc.

	- I don't know
	- just because/ I think so
	- we have a tree in our yard (irrelevant content)
	- other

1 Focus on Surface features or misconceptions

	-string not tree stores energy
	-elephant stronger than man (i.e., features of "thrower")
	-happened in TV show
	*-pull down tree -> rock goes far (no explicit relation between the tree and the launching of the rock)
	-other

2 A. Focus on Mechanism (reference to advantage of bent tree) without explanation

	-tree springs or straightens out ->rock is thrown
	-tree higher than person (so have to pull farther or throws farther/higher)
	*-tree throws further than X
	-other

OR

B. Focus on knots/ratchet: without explanation of incremental storage

	-better grip with knots. easier to pull
	*-don't get as tired
	-other

3 A. References to advantage with explanation

	-the more energy used to bend tree, the more energy it has to throw the rock
	-Tree stores the energy from being pulled back, pull further = more energy
	-other

OR

B. Explanation of incremental storage of energy

	- Can pull together
	-can pull little by little (i.e., the ratchet)
	-can let go if tired (assuming discussion of ratchet) and come back where let off
	-other

4 Explanation integrating advantage AND incremental storage of energy

	-includes aspects of 3A **AND** 3B
	-other

Explaining the Trebuchet (arm)

0 -Can't tell, nonsense, etc.

	- I don't know
	- just because/ I think so
	- we have a tree in our yard (irrelevant content)
	- other

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1 Focus on Surface features (size, strength of thrower, etc.) or misconceptions

	-string (not arm/device) stores energy
	-elephant/mammoth is stronger than man (i.e. focus on features of thrower)
	-happened in TV show
	-other

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2 Focus on Mechanism (must mention counterweight) /reference to advantage without explanation. (Response in this category describes the sequence of events without any interpretation or explanation of how/why the mechanism works)

	- pull vine -> counterweight goes up; counterweight drops -> rock goes far
	- counterweight "heavier than tree" or person jumping on lever (so throws farther)
	-trebuchet throws farther than X (i.e., other device)
	-other

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3 A. Focus on Mechanism: References to advantage with explanation

	- energy used to lift counterweight stored in arm and throws rock further
	- the heavier the countepweight the more energy needed to lift it and the more energy stored to throw rock
	-the longer arm needs more energy to lift so more energy in arm to throw rock further
	-other

OR

B. Explanation of incremental storage of energy

	- Can pull together
	-can pull little by little (i.e., the ratchet)
	-can let go if tired (assuming discussion of ratchet) and come back where let off
	-other

4 Explanation integrating advantage and incremental storage of energy

	-includes aspects of 3A AND 3B
	-other

Storage of Energy

How to make the device throw farther

Tree

0- Can't tell, irrevelant, nonsense

	- I don't know
	- just because/ I think so
	- just try it (irrelevant content)
	- other

1- Misconceptions

	-Use longer string
	-other

2- Viable Solutions - Unrelated to Storage of Energy

	Get taller tree
	-other

3- Viable Solutions- Related to Storage of Energy

	-Pull branch down lower, bend tree back further
	-Get stronger tree (so use more energy to pull down)
	-other

Trebuchet

0- Can't tell, nonsense

	- I don't know
	- just because/ I think so
	- just try it (irrelevant content)
	- other

1- Misconceptions

	Use longer string
	Use bigger spoon (i.e., arm)
	other

2- Viable Solutions -Unrelated to Storage of Energy

	-Build higher/bigger
	-other

3- Viable Solutions - Related to the Storage of Energy

	-Pull arm lower
	-Get heavier counterweight
	-other

Role of Knots/Ratchet

Which is Better?

0 -	No Knots
	-other
1 -	Knots

Explanation

0 -	Can't Tell, Nonsense, etc.
	other

1 - Surface Features/Misconceptions

	-Knots give better grip
	-Harder with knots because they catch on stump
	-Don't get as tired/Don't have to work as hard (with no further explanation)
	-other

2 - Explanation involving Knots function as Ratchet

	-Knots hold vine in place between pulls
	-Can release and not lose energy/not have tree, trebuchet snap back
	-Can rest between pulls
	-other

Appendix F2:

Interview Two Coding Packet:

Heat and Insulation

Coder name: _____ Date:_____

Student name:_____

Condition:_____

School:_____

Coding for Heat Interview (Interview 2)

Sorting Explanations

(*indicates an ambiguous response - probe more in order to code correctly)

Sorting Task 1

Around Hot Rocks. No Tank

0 Can't tell, irrelevant, nonsense, etc

	- I don't know
	- just because/ I think so
	- the mountain is high (irrelevant content)
	-other

1 Focus on Surface features or misconceptions

	-rocks won't fall down and mess it up
	-people can see you taking shower
	-water comes down straighter/faster
	-other

2 Answer mentions the inadequacy of the water stream

	-Water just drips out
	-Water doesn't come down hard enough
	-other

3 Answer dependent on lack of constant heat source

	-there's no hot rocks around the pipes; it won't keep hot
	-other

4 Answer mentions covered pipes as insulators/uncovered pipes poor insulators

	-covered pipes keep water warm from wind/cold air
	-uncovered pipes will make water cool from air
	-other

5 Answer explicitly mentions how insulation works

	-covered pipes stops/slows the heat from getting out
	-covered pipes help keep the heat of the water in
	-other

Sorting Task 1

Over Hot Rocks /No tank

0- Can't tell, irrelevant, nonsense, etc

	- I don't know
	- just because/ I think so
	- the mountain is high (irrelevant content)
	- other

1 Focus on Surface features or misconceptions

	-rocks might fall down and mess it up
	-rocks might fall down and stop/block the water
	-people can see you taking shower
	-hot rocks could burn pipes
	-other

2 Answer mentions the inadequacy of the water stream

	-Water just drips out
	-Water doesn't come down hard enough
	-other

3 Answer dependent on transfer of heat

	-rocks so hot it makes water hot
	-heat from the rocks makes/keeps the water hot
	-other

4 Answer mentions covered pipes as insulators/uncovered pipes poor insulators

	-covered pipes keep water warm from wind/cold air
	-uncovered pipes will make water cool from air
	-other

5 Answer explicitly mentions how insulation works

	-covered pipes stops/slows the heat from getting out
	-covered pipes help keep the heat of the water in
	-other

Sorting Task 2

No Tank

0 Can't tell, nonsense, etc

	- I don't know
	- just because/ I think so
	- because it's round; its too high (irrelevant content)
	-other

1 Focus on Surface features or misconceptions

	-Easier to build
	-Looks like a shower
	-water always there
	-other

2 Relevant Properties

	-Mentions water stream inadequate (just drips, not hard enough)
	-other

OR

	-No tank better because water is hotter (than water stored in tank)
	-Water cools down as it sits in tank so no tank is better
	-other

Sorting Task 2

Tank without Cover

0- Can't tell, nonsense, etc

	- I don't know
	- just because/ I think so
	- because it's round; its too high (irrelevant content)
	-other

1- Surface Features/misconceptions (insulation not recognized as blocking heat transfer)

	-wood tank won't leak
	-stays warm because sun shines on it
	-wood keeps things warm like when you make a fire
	-other

2- Mentions insulation with no explanation

	-there's no cover/ it's not wrapped
	-other

OR

Misconception of insulation regarding direction of energy transfer

	-when wind blows it will cool the water
	-the snow/cold air will get in and cool the water
	-other

3 Recognizes insulator as blocking transfer of heat (e.g., mentions transfer of heat from something hot to something cold/explains insulation in terms of the prevention of heat transfer

	- cover keeps heat in
	-cover slows down the loss of heat in water
	-other

Sorting Task 2

Covered Tank

0- Can't tell, nonsense, etc

	- I don't know
	- just because/ I think so
	- because it's round; its too high (irrelevant content)
	-other

1- Surface Features/misconceptions (insulation not recognized as blocking heat transfer)

	-straw leaks
	-grass won't hold easily
	-straw gets so hot it will burn
	-cover makes water hot
	-other

2- Mentions insulation with no explanation

	-water will be hot because there's a cover
	-cover keeps water hot/warm
	-other

or

Misconception of insulation regarding direction of energy transfer

	-cover keeps wind/snow/rain/cold out
	-cover keeps snow out so it won't cool the water
	-other

3- Recognizes insulator as blocking transfer of heat (e.g., mentions transfer of heat from something hot to something cold/explains insulation in terms of the prevention of heat transfer

	- cover keeps heat in
	- cover slows down the loss of heat from water to air
	-other

Appendix F3:

Interview Three Coding Packet:
Timekeepers

Coder name: _____ **Date:**_____

Student name:_____

Condition:_____

School:_____

Coding for Time Keeping Interview (Interview 3)

Sorting Explanations

(*indicates an ambiguous response - probe more in order to code correctly)

Explaining Pebbles in Bucket

0 Can't tell, irrelevant, nonsense, etc

	- I don't know
	- just because/ I think so
	- I collect pebbles/I saw Pebbles on the Flinstones (irrelevant content)
	- other

1 Focus on Surface features or misconceptions, no recognition of regularity/ focus on total length of time (e.g., "it will take longer" w/o elaboration)

	-your hands will get tired
	-counting is better because it will take longer
	-counting not as easy
	-other

2 Answer dependent on ability to do other things

	-how could you baby-sit if you're moving rocks
	-other

3 Refers to regularity/rate w/o discussing irregularity that occurs when different people are counting (recognizes regularity/rate as important)

	-so simple, just pick the best way to drop the pebbles, do 1 drop per second
	-other

4 Answer dependent on accuracy/regularity of device (recognizes that pebbles are NOT a good way)

	-the man could be playing with them and could get messed up
	-you could just dump all the pebbles into the other bucket all at once
	-easy to cheat and put pebbles in the bucket by the handful
	-other

Explaining the Sand Clock

0 Can't tell, nonsense, etc

	- I don't know
	- just because/ I think so
	-other

1 Focus on Surface features/misconceptions/regularity not an issue/ focus on total length of time (e.g., "it will take longer" w/o elaboration)

	-easy to make
	-it's fast, goes quicker than other ways/*it goes slower
	-when it's finished there's no noise of sand falling, so you know it's time to change
	-it can tell the hours
	-you don't get as tired
	-the hole is smaller
	-because this is the easiest way to tell time
	-other

2 Answer dependent on ability to do other things

	*-all you need to do is put in sand
	-you don't have to count
	*-sand goes in the bucket by itself
	*-you have more time to baby-sit
	-other

3 Answer mentions calibration

	-hole this small will take the exact time to finish baby-sitting; if hole is big then it will just drop, you take one look at the baby and you're done
	-More than one person can jump at same time (more force)
	-other